

What is claimed is:

1. A carrier head for a chemical mechanical polishing apparatus, comprising:  
a carrier structure;

5 a flexible membrane extending below the carrier structure, the flexible membrane having an outer membrane portion and an inner membrane portion, wherein the outer membrane portion provides a substrate-mounting surface and the inner membrane portion is joined to a central section of the outer membrane portion; and

a plurality of chambers between the flexible membrane and the carrier structure, the  
10 plurality of chambers configured to apply a first pressure to a substrate in an annular loading area having an inner diameter, wherein the plurality of chambers permits control of the first pressure applied to the substrate in the loading area and the inner diameter of the annular loading area, the plurality of chambers including a first chamber between the carrier structure and the inner membrane.

15 2. The carrier head of claim 1, wherein evacuation of the first chamber draws the inner membrane portion upwardly and pulls the central section of the outer membrane portion away from the substrate to increase an inner diameter of an annular section of the outer membrane portion that contacts the substrate.

20 3. The carrier head of claim 2, wherein pressurization of a second chamber pushes the outer membrane portion outwardly to apply a load to the annular loading area, the second chamber located between the inner membrane portion and the outer membrane portion.

25 4. The carrier head of claim 2, further comprising a fluid connection to a volume between the central section of the outer membrane and the substrate.

30 5. The carrier head of claim 4, further comprising a valve in the fluid connection between the central section of the outer membrane and the substrate.

6. A method of polishing a substrate, comprising:

providing a carrier structure having a flexible membrane, wherein the flexible membrane has an inner portion and an outer portion and the inner and outer portions are  
5 joined at a central portion of the flexible membrane and a first chamber is between the inner portion and the carrier structure;

bringing at least a portion of a bottom surface of the outer portion into contact with a substrate;

pumping fluid out of the first chamber to pull a central portion of the bottom surface  
10 away from the substrate; and

creating a relative motion between the flexible membrane and the substrate.

7. The method of claim 6, further comprising pumping fluid into a second chamber between the inner portion and the outer portion to apply a load to an annular portion  
15 of the substrate.

8. The method of claim 6, further comprising pumping fluid into a fluid supply line connected to the central portion of the flexible membrane to cause a greater load to be applied to an annular portion of the substrate than is applied to the central portion of the  
20 substrate.